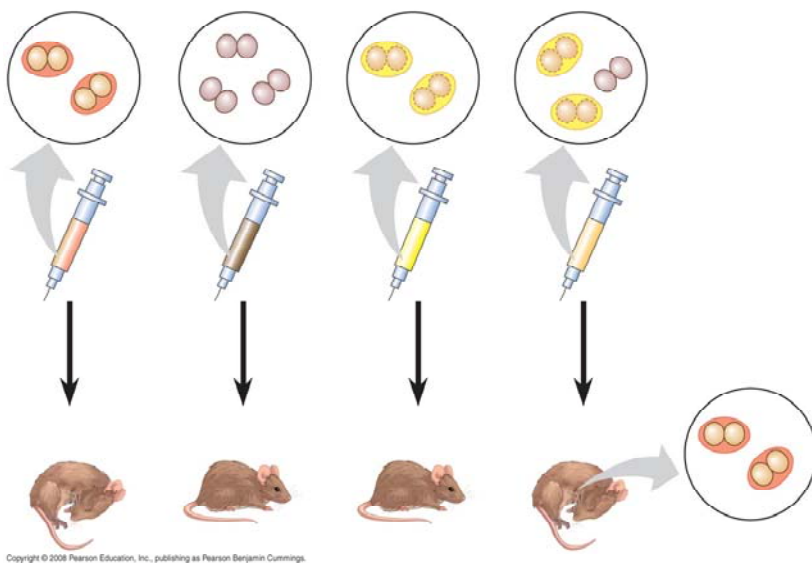


Name _____ Period _____

Chapter 16: The Molecular Basis of Inheritance

Concept 16.1 DNA is the genetic material

1. What are the two chemical components of chromosomes?
2. Why did researchers originally think that protein was the genetic material?
3. Distinguish between the virulent and nonvirulent strains of *Streptococcus pneumoniae* studied by Frederick Griffith.
4. What was the purpose of Griffith's studies?
5. Use this figure to summarize the experiment in which Griffith became aware that hereditary information could be transmitted between two organisms in an unusual manner.



6. Define *transformation*.

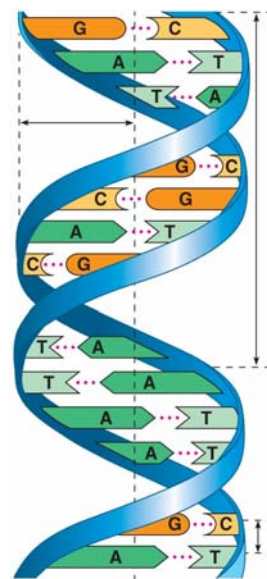
7. What did Oswald Avery determine to be the *transforming factor*? _____ Explain his experimental approach.
8. Sketch a *T2 bacteriophage* and label its *head*, *tail sheath*, *tail fiber*, and *DNA*.
9. How does a bacteriophage destroy a bacterial cell? Look ahead to Chapter 19, Figure 19.5, to explain this.
10. How did Hershey and Chase “label” viral DNA and viral protein so that they could be distinguished? Explain why they chose each radioactive tag in light of the chemical composition of DNA and protein.
11. Describe the means by which Hershey and Chase established that only the DNA of a phage enters an *E. coli* cell. What conclusions did these scientists draw based on these observations?
12. What are *Chargaff's rules*? How did he arrive at them?
13. List the three components of a nucleotide.

14. Who built the first model of DNA and shared the 1962 Nobel Prize for discovery of its structure?
15. What was the role of Rosalind Franklin in the discovery of the *double helix*?
16. Distinguish between the structure of *pyrimidines* and *purines*. Explain why adenine bonds only to thymine.
17. How did Watson and Crick's model explain the basis for Chargaff's rules?
18. Given that the DNA of a certain fly species consists of 27.3% adenine and 22.5% guanine, use Chargaff's rules to deduce the percentages of thymine and cytosine.
19. Name the five nitrogenous bases, and put a checkmark in the correct column for each base. Also indicate if the base is found in DNA (D), RNA (R), or both (B).

Nitrogenous Base	Purine	Pyrimidine	D, R or B

20. Explain the base-pairing rule.
21. Describe the structure of DNA relative to each of the following:

- a. distance across molecule _____
- b. distance between nucleotides _____
- c. distance between turns _____
- d. components of the backbone _____
- e. components of the “rungs” _____

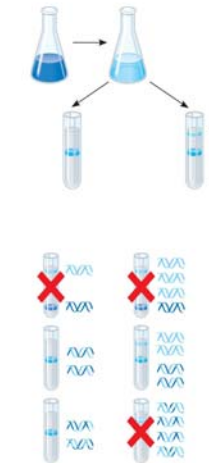


22. Explain what is meant by 5' and 3' ends of the nucleotide.
23. What do we mean when we say the two strands of DNA are *antiparallel*?

Concept 16.2 Many proteins work together in DNA replication and repair

24. What is the *semiconservative model of replication*?
25. Who performed the experiments that elucidated the correct mechanism of DNA replication?

26. How did Meselson and Stahl create “heavy” DNA for their experiments?
27. Use Figure 16.11 to explain how Meselson and Stahl confirmed the semiconservative mechanism of DNA replication.

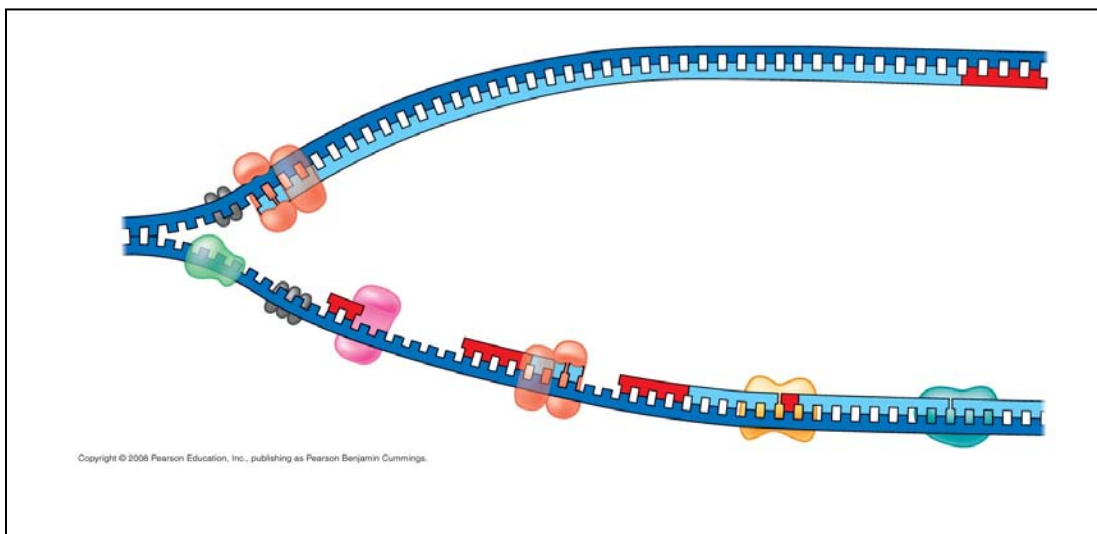
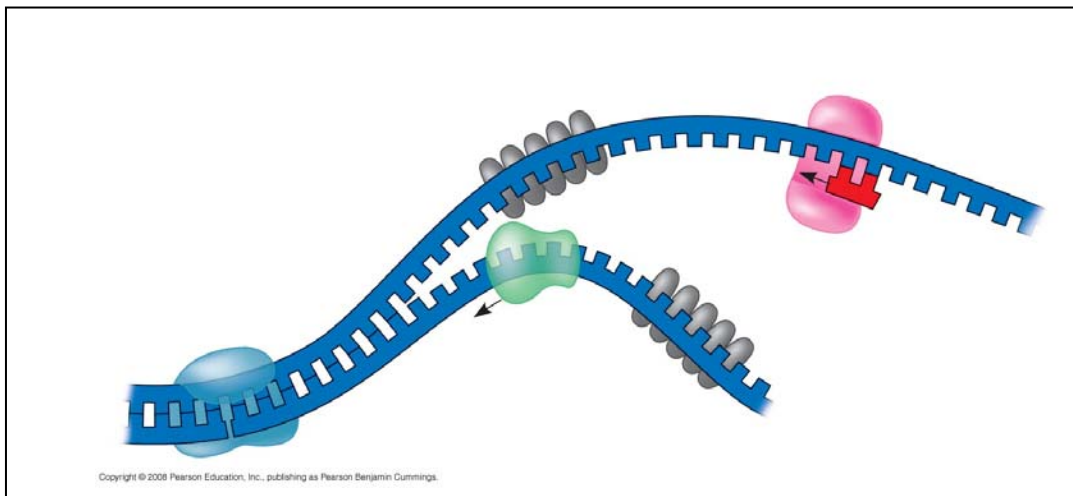


28. Define the *origins of replication*.
29. Distinguish between the *leading* and the *lagging strands* during DNA replication.
30. What is the direction of synthesis of the new strand?
31. What are *Okazaki fragments*? How are they welded together?
32. Which enzyme . . . ?

a. untwists and separates strands	
b. holds DNA strands apart	

c. synthesizes RNA primer	
d. adds DNA nucleotides to new strand	
e. relieves strain caused by unwinding	
f. joins DNA fragments together	
g. removes RNA primer and replaces with DNA	

33. Label the following figures. Include *3' and 5' strands*, *RNA primer*, *primase*, *SSBP*, *topoisomerase*, *helicase*, *leading strand*, *lagging strand*, *DNA pol I*, *DNA pol III*, *DNA ligase*, *parental DNA*, and *new DNA*.



34. *Put it all together!* Make a detailed list of the steps that occur in the synthesis of a new strand.

35. Explain the roles of each of the following enzymes in DNA proofreading and repair.

Enzyme	Role
DNA polymerase	
Nuclease	
Ligase	
Repair enzymes	

36. What is a *thymine dimer*? How might it occur? How is it repaired?

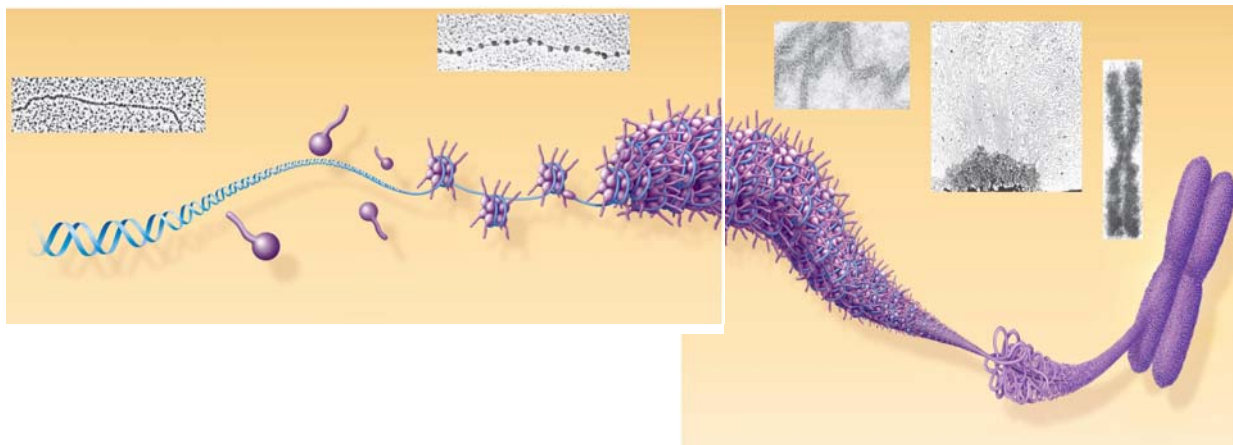
37. Make a sketch of a chromosome and label the *telomeres*.

38. Explain telomere erosion and the role of *telomerase*.

39. Why are cancer cells immortal, but most body cells have a limited life span?

Concept 16.3 A chromosome consists of a DNA molecule packed together with proteins

40. On the diagrams below, identify the following: 30-nm fiber, metaphase chromosome, double helix, histone proteins, nucleosomes, protein scaffold, and looped domains (300-nm fiber).



41. Distinguish between *heterochromatin* and *euchromatin*.

Testing Your Knowledge: Self-Quiz Answers

Now you should be ready to test your knowledge. Place your answers here:

1. _____ 2. _____ 3. _____ 4. _____ 5. _____ 6. _____ 7. _____ 8. _____